WHAT IS CLAIMED IS:

1. An apparatus for automatically focusing an image of an object plane in a microscope, comprising:

an optical system configured to form an image of an object plane to be observed, said optical system comprising:

an objective lens configured to focus on the object plane,

an illumination beam source for illuminating the object plane with an illumination light beam, and

an image lens configured to create an image of the object plane;

an autofocusing detection system comprising:

an autofocusing light beam source for generating an autofocusing light beam,

a beamsplitter configured to direct the autofocusing light beam to the object plane and cause the autofocusing light beam to reflect off the object plane,

a detection system lens configured to direct the reflected autofocusing light beam to an autofocusing detection device, and

an autofocusing detection device for determining the amount of displacement of the image of the object plane in the optical system from a desired focused reference plane based on the detected displacement of an image plane of the reflected autofocusing light beam from a predetermined reference plane in the autofocusing detection system, said autofocusing detection device comprising at least

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one sensor for sensing the reflected autofocusing light beam and detecting the displacement of the image plane; and

a focusing correction system comprising a feedback controller and focus adjusting device for automatically adjusting the distance between the objective lens and the object plane, based on the reflected autofocusing light beam sensed by said at least one sensor, in order to properly focus the image in the optical system.

2. The apparatus of claim 1, wherein the autofocusing detection device further comprises an iris for permitting the reflected autofocusing light beam to pass at least partially through an aperture of the iris, said at least one sensor measuring the intensity of the reflected autofocusing light beam that passes through the aperture of the iris.

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3. The apparatus of claim 2, wherein the iris is approximately positioned at the focal distance from the detection system lens and wherein the sensor is positioned adjacent the aperture of the iris.

4. The apparatus of claim 2, wherein the iris is positioned such that it is displaced from the focal distance from the detection system lens and wherein the sensor is positioned adjacent the aperture of the iris.

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Sub B1

5. The apparatus of claim 4, wherein the autofocusing detection device further comprises an auxiliary beam splitter and an auxiliary light sensor, the auxiliary beam splitter positioned between the detection system lens and the iris, the auxiliary beam splitter configured to reflect a fraction of the reflected autofocusing light beam to the auxiliary light sensor.

6. The apparatus of claim 5, wherein the displacement of the reflected autofocusing light beam from the predetermined reference plane is calculated based on the light intensities measured by the light sensor and auxiliary light sensor, and wherein the feedback controller calculates the displacement of the image from the desired focused reference plane based on the displacement of the reflected autofocusing light beam from a predetermined reference plane.

7. The apparatus of claim 1, wherein the at least one sensor comprises a plurality of diodes for measuring the light intensity and position of the reflected autofocusing light beam on a detection surface.

8. The apparatus of claim 7, wherein the autofocusing detection device further comprises a prism positioned between the detection system lens and the plurality of diodes, said prism configured to divide the reflected autofocusing light beam into at least two separate beams.

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9. The apparatus of claim 8, wherein the plurality of diodes comprise two diode pairs, the first diode pair being substantially aligned with a first light beam from the prism, the second diode pair being substantially aligned with a second light beam from the prism, said diode pairs measuring the intensity of the first and second light beams that strike each diode pair.

10. The apparatus of claim 9, wherein the first diode pair is located on a first side of the optical axis of the detection system lens and the second diode pair is located on a second side of the optical axis of the detection system lens, the first diode pair comprising a first and second diode, the second diode pair comprising a third and fourth diode, and wherein the light intensity measured by the individual diodes changes as a function of the distance between the object plane and the objective lens.

11. The apparatus of claim 7, wherein the autofocusing detection device further comprises a cylindrical lens positioned between the detection system lens and the plurality of diodes, said cylindrical lens configured to change the shape of a light spot of the reflected autofocusing light beam on the plurality of diodes when the distance between the object plane and objective lens changes.

12. The apparatus of claim 11, wherein the plurality of diodes comprises a quad photo diode with four distinct diode segments.

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13. The apparatus of claim 1, wherein the feedback controller calculates the displacement of the image from the desired focused reference plane based on the detected displacement of the reflected autofocusing light beam from the predetermined reference plane.

14. The apparatus of claim 1, wherein the autofocusing detection system is configured so that the measured displacement of the reflected autofocusing light beam from the predetermined reference plane is proportional to the amount of displacement of the image from the desired focused reference.

15. The apparatus of claim 1, wherein the illumination light beam and autofocusing light beam are selected to have different wavelengths so that the light beams do not interfere with one another.

16. The apparatus of claim 1, wherein the focus adjusting device is configured to adust the position of the objective lens in order to properly focus the optical system on the object plane.

17. The apparatus of claim 1, wherein the focus adjusting device is configured to adjust the position of the object plane in order to properly focus the optical system on the object plane.

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18. A system for automatically focusing an image in a microscope, comprising:

an imaging system for creating an image of an object plane using an illumination light beam of a first wavelength; and

an autofocusing detection system, said autofocusing detection system comprising:

an autofocusing light beam of a second wavelength, the autofocusing light beam being directed to reflect off of the object plane;

an autofocusing detection device comprising an iris and a light detector; and

a detection system lens for directing the reflected autofocusing light beam to the autofocusing detection device, the autofocusing detection device receiving the reflected autofocusing light beam from the detection system lens, said iris permitting at least a portion of the reflected autofocusing light beam to pass through an aperture of said iris, and said light detector measuring the intensity of the portion of the reflected autofocusing light beam that passes through the aperture of the iris in order to detect the distance that the image of the object plane in the imaging system is displaced from a desired focus reference surface.

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19. The system of claim 18, wherein the iris is approximately positioned at the focal distance from the detection system lens and the wherein the light detector is positioned adjacent the aperture of the iris.

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20. The system of claim 18, wherein the iris is positioned such that it is displaced from the focal distance from the detection system lens and wherein the light detector is positioned adjacent the aperture of the iris.

Sub B2

21. The system of claim 20, wherein the autofocusing detection device further comprises an auxiliary beam splitter and an auxiliary light detector, the auxiliary beam splitter positioned between the detection system lens and the iris, the auxiliary beam splitter configured to reflect a fraction of the reflected autofocusing light beam to the auxiliary light detector.

22. The system of a claim 18, said imaging system comprising an objective lens, said system further comprising a focus correction system comprising a feedback controller and focus adjusting device for automatically adjusting the distance between the objective lens and the object plane, based on the reflected autofocusing light beam sensed by said light detector, in order to properly focus the image in the imaging system.

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23. The system of claim 22, wherein the focus adjusting device is configured to adust the position of the objective lens in order to properly focus the imaging system on the object plane.

24. The system of claim 22, wherein the focus adjusting device is configured to adust the position of the object plane lens in order to properly focus the imaging system on the object plane.

25. The system of claim 18, wherein the distance that the image of the object plane in the imaging system is displaced from a desired focus reference surface is a function of the light intensity measured by the light detector of the autofocusing detection device.

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26. A system for automatically focusing an image in a microscope, comprising:

an imaging system for creating an image of an object plane using an illumination light beam of a first wavelength; and

an autofocusing detection system, said autofocusing detection system comprising:

an autofocusing light beam of a second wavelength, the autofocusing light beam being directed to reflect off of the object plane;

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an autofocusing detection device comprising a plurality of light sensors; and

a detection system lens for directing the reflected autofocusing light beam to the autofocusing detection device, the autofocusing detection device receiving the reflected autofocusing light beam from the detection system lens, said plurality of light sensors measuring the light intensity of the reflected autofocusing light beam in order to detect the distance that the image of the object plane in the imaging system is displaced from a desired focus reference surface.

27. The system of claim 26, wherein the autofocusing detection device further comprises a prism positioned between the detection system lens and the plurality of light sensors, said prism configured to divide the autofocusing beam into at least two separate beams, the plurality of light sensors comprising at least two sensor pairs, the first sensor pair being substantially aligned with a first light beam from the prism, the second sensor pair being substantially aligned with a second light beam from the prism, said sensor pairs measuring the intensity of the light beam that strikes each sensor pair.

28. The system of claim 26, wherein the autofocusing detection device further comprises a cylindrical lens positioned between the detection system lens and the plurality of light sensors, said cylindrical lens configured to change the shape of a light

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spot on the plurality of diodes when the distance between the object plane and objective lens changes.

29. The system of claim 28, wherein the plurality of light sensors comprises a quad photo diode with four distinct diode segments.

30. The system of a claim 26, said imaging system comprising an objective lens, said system further comprising a focus correction system comprising a feedback controller and focus adjusting device for automatically adjusting the distance between the objective lens and the object plane, based on the reflected autofocusing light beam sensed by said light detector, in order to properly focus the image in the imaging system.

31. The system of claim 30, wherein the focus adjusting device is configured to adust the position of the objective lens in order to properly focus the imaging system on the object plane.

32. A method of automatically focusing an image of an object plane in a microscope, comprising:

generating an autofocusing light beam;

directing the autofocusing light beam against the object plane to be examined;

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reflecting the autofocusing light beam off the object plane;

directing the reflected autofocusing light beam to a detection system;

sensing the autofocusing light beam with a light detector of the detection system;

determining, based on the sensed autofocusing light beam, the amount of displacement of the image plane of the reflected autofocusing light beam from a desired reference plane; and

focusing on the object plane to create a properly focused image,

wherein said sensing includes transmitting the reflected autofocusing light beam at least partially through an aperture of an iris and measuring the light intensity of the reflected autofocusing light beam that is transmitted through the aperture with the light detector of the detection system.

33. The method of claim 32, wherein the iris is approximately positioned at the focal distance from a detection system lens and wherein the light detector is positioned adjacent the aperture of the iris.

34. The apparatus of claim 32, wherein the iris is positioned such that it is displaced from the focal distance from a detection system lens and wherein the light detector is positioned adjacent the aperture of the iris.

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35. The method of claim 34, wherein said directing includes reflecting a fraction of the autofocusing light beam via a beam splitter to a second light detector and measuring the light intensity at the second light detector.

36. The method of claim 32, further comprising, simultaneously with said generating of the autofocusing light beam:

generating an illumination light beam;

illuminating the object plane with the illumination light beam; and

reflecting the illumination light beam off the object plane to create an image of the object plane.

37. The method of claim 36, wherein said focusing includes creating a reference signal representative of the amount of displacement of the image of the object plane from a desired focused reference plane.

38. A method of automatically focusing an image of an object plane in a microscope, comprising:

generating an autofocusing light beam;

directing the autofocusing light beam against the object plane to be examined;

reflecting the autofocusing light beam off the object plane;

directing the reflected autofocusing light beam to a detection system;

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sensing the autofocusing light beam with a plurality of light detectors of the detection system;

determining, based on the sensed autofocusing light beam, the amount of displacement of the image plane of the reflected autofocusing light beam from a desired reference plane; and

focusing on the object plane to create a properly focused image,

wherein said determining includes comparing the light intensities of the reflected autofocusing light beam detected by the light detectors.

39. The method of claim 38, wherein said sensing the autofocusing light beam includes dividing the autofocusing light beam into at least two separate light beams by a prism positioned between a detection system lens and the plurality of light detectors.

40. The method of claim 39, wherein said sensing the autofocusing light beam includes measuring the light intensity at two diode pairs, the first diode pair being substantially aligned with a first light beam from the prism, the second diode pair being substantially aligned with a second light beam from the prism.

41. The method of claim 38, wherein said sensing the autofocusing light beam includes transmitting the autofocusing light beam through a cylindrical lens positioned

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between a detection system lens and the plurality of light detectors to alter the shape of a light beam projected onto the light detectors.

42. The method of claim 41, further comprising providing, as the light detectors, a quad photo diode with four distinct diode segments.

43. The method of claim 38, further comprising, simultaneously with generating the autofocusing light beam:

generating an illumination light beam;

illuminating the object plane with the illumination light beam; and

reflecting the illumination light beam off the object plane to create an image of the object plane.

44. The method of claim 43, wherein said focusing includes creating a reference signal representative of the amount of displacement of the image of the object plane from a desired focused reference plane.

45. A microscope for viewing an object plane, comprising:

a plurality of lenses positioned along a main optical axis of the microscope;

a probe arm supporting the plurality of lenses, said probe arm extending generally along the main optical axis;

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a support on which an object with an object plane to be examined is placed, the object plane substantially extending along a focus plane that is observed through the microscope; and

an optical output device for creating an image of the object plane on an image plane,

wherein the main optical axis is unfolded and substantially extends along a single plane.

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46. The microscope of claim 45, further including a second optical axis, the second optical axis being positioned between the focus plane and the main optical axis, the second optical axis being substantially perpendicular to the main optical axis.

47. The microscope of claim 46, further comprising a third optical axis being positioned between the main optical axis and image plane in the optical output device, the third optical axis being configured at an angle relative to the main optical axis.

48. The microscope of claim 45, wherein the focusing plane is substantially parallel to the main optical axis.

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49. The microscope of claim 45, further comprising a scanning stage, said probe arm configured to be substantially isolated from vibrations created by the scanning stage.

50. The microscope of claim 49, wherein the scanning stage and object are positioned on a separate support structure than the probe arm of the microscope, each separate support structure being substantially vibrationally isolated from each other.

Sub B3

51. The microscope of claim 50, wherein the object to be examined is positioned on a support connected to the separate support structure of the scanning stage and said probe arm positioned between the object to be examined and the scanning stage.

52. The microscope of claim 45, wherein the probe arm is substantially elongated so that the optical output device may be positioned distant from the object to be examined.

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